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C-A OPERATIONS PROCEDURES MANUAL

14.31.2 Occupational Safety and Health Training Summary for
C-AD Operations and Maintenance Activities

(Occupational Health and Safety Training Package
for Accelerator and Experimental Activities)

Text Pages 2 through 9

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Approved: _____ Signature on File _____
Collider-Accelerator Department Chairman Date

E. Lessard

Occupational Health and Safety Training Package for Accelerator and Experimental Activities

This package has been designed to aid in the delivery of required job-specific training for the work activities identified in the [Workplace Hazard and Risk Assessment for Accelerators](#), and for the specific hazards and controls identified in [Facility Risk Assessments \(FRAs\)](#) and [Job Risk Assessments \(JRAs\)](#).

Your position has been determined to have a potential to significantly impact the safety and health of yourself and others. Thus, C-A Department Management has prepared the questions and answers on the following pages for your specific work/processes.

This safety and health material is incorporated into your current job and procedure training. If you have specific questions about this information after you have read the material, contact the C-A Department ESH&Q Division Head, Ray Karol (<mailto:rck@bnl.gov>).

You may keep this material as a handout and use it as a reference aid.

This specific training course is linked to your job-training assessment (JTA). You must read and acknowledge this material as part of the qualification to perform work in the accelerators. Please fill out the [Read and Acknowledgement form](#) on the last page, print it and return it promptly.

Occupational Health and Safety Training Package for Accelerator and Experimental Activities

Accelerator Hazards:

- Ionizing Radiation
- Non-ionizing Radiation
- Hazardous or Toxic Materials
- Radioactive Materials
- Electrical Energy
- Explosive Gases and Liquids
- Oxygen Deficiency
- Kinetic Energy
- Potential Energy
- Thermal Energy
- Cryogenic Temperatures
- Protracted/Irregular Hours
- Natural Hazards

Contacts for Further ESHQ Information:

Associate Chair for ESHQ, OSH Management Representative,
EMS Management Representative, E. Lessard
Head of ESHQ Division, General Building Manager, R. Karol
Environmental Coordinator, J. Scott
Environmental Compliance Representative, M. VanEssendelft
ESH Coordinator, Access Controls Physicist, Laser Coordinator,
Tier 1 Coordinator, A. Etkin
Radiological Control Division Representative, P. Bergh
Procedures Coordinator, L. DiFilippo
ISSM Point of Contact, Quality and Assessment Manager, D. Passarello
Self Evaluation Program, J. Maraviglia
Source Custodian, Work Control Manager, P. Cirnigliaro
Training Coordinator, Training Manager, J. Maraviglia
Training Records, A. Luhrs

Course Objective: Because your work activities have been identified as having significant potential to impact yours and others safety and health, this course has been designed to provide you with the job-specific information that you must know to protect yourself and others from hazards encountered in the accelerators.

1) What hazards are associated with your activities?

- Several primary beam areas such as the Linac, Booster Ring, AGS Ring, 912 Switchyard, 912 Target Caves, and g-2 Experimental Areas, are High Radiation Areas during shutdown or maintenance days. The residual radiation level may be greater than 100 mrem per hour in these areas. Other accelerator locations such as NSRL, RHIC and Tandem have lower level hazards, typically less than 5 mrem in an hour during maintenance periods. High levels of ionizing radiation can damage organs and the skin, cause cataracts, and cause cancer.

- Although the dominant shield materials are concrete and iron, lead shielding is sparsely found throughout the complex. In any handling operation, routine industrial hygiene procedures must be followed. Lead is a neurotoxin, nephrotoxin and teratogen. Poisoning may also affect the blood, heart, and the endocrine and immune systems.
- Materials Safety Data Sheets must be used by personnel who work with hazardous chemicals. Typical chemicals include cleaning agents, solvents, water treatment chemicals, lead and beryllium.
- Welding gases and flammable/explosive gases in experimental detectors are widely used and must be stored according to National Fire Protection Association codes. Gases stored in compressed gas cylinders must meet DOT specifications.
- The personnel risks associated with the fire hazard are considered low. The fire protection of some accelerator buildings is improved by the installation of sprinkler systems. Emergency power and lighting are available in all parts of the accelerator complex and the maximum travel distance from any point to an exit is less than 300 feet.
- Electrical hazards leading to personnel injury include electrical shock and arc blast. High voltages and high currents are present in many parts of the ion accelerator complex. Electric arcs can cause fatal skin burns, hearing loss, lung damage and eye damage. Electric shock can cause damage to nerve tissue and the circulatory system, plus stop the heart.
- The RHIC tunnel, RHIC compressor and refrigerator buildings, RHIC Service and Support Buildings, He Reliquifer Building 1005E and Building 919 contain large volumes of cryogenic liquid that can be released to create an oxygen deficiency hazard.
- High direct current magnetic fields may be present in accelerator and experimental area magnets, particularly spectrometer magnets. These magnetic fields can interfere with pacemakers, and attract ferrous objects turning them into missiles.
- Many areas contain high power rf systems that generate large fields of electromagnetic radiation in the frequency range of a few hundred kilohertz to a few hundred megahertz. Exposure to electromagnetic radiation in this frequency range at high power levels can cause tissue damage. The body absorbs this radiation and significant internal heating may occur without an individual's knowledge because the body does not have internal sensation of heat. Tissue damage may occur before the excess heat can be dissipated.
- Heat sources such as soldering irons and vacuum heating blankets exist in several areas of the accelerator complex. Cryogenic liquids exist in several areas of the accelerator complex. Skin contact with cryogenic materials due to spills or splashes may cause freezing or "cryogenic burns."
- Kinetic energy hazards are associated with motorized materials handling equipment, manual lifting and with the operation of hand and shop tools. Overexertion injuries can be caused by excessive lifting, pushing, pulling, holding, and carrying. Getting struck by tool or hitting other objects or people with moving equipment can cause injuries.
- Potential energy hazards are those associate with compressed gases and vacuum windows, slippery or uneven walking and working surfaces, as well as those associated with hoisting and rigging operations. Falls at the same level or to a lower level can cause severe injuries and death.
- Natural hazards are those associated with animals and insects. Insect bites and stings, animal bites and traffic accidents as a result of animals in the roadway are possible causes of injury.

- Lasers are common throughout the complex, and lasers can cause debilitating eye damage.
- Noise levels greater than 85 db are possible. Noise areas are posted and hearing protection is required. Excessive noise exposure can cause permanent hearing loss.

2) What consequences may result if your operations were to impact safety and health?

- Not following the OSH rules could injure myself and others, incur regulatory penalties and cause extended accelerator shutdowns
- Injuries and illnesses can create loss of DOE, regulator and public trust

3) What benefits or positive effects would you notice with improved OSH performance?

- Prevention of injury/illness
- Safer, cleaner workplace
- Clear roles and responsibilities
- Improved relationship with DOE, regulators and the public

4) What role and responsibility do you have for these potential impacts and OSH performance?

My responsibilities are:

- To prevent work-related injuries, ill health and incidents
- To comply with C-AD occupational safety and health requirements
- Where appropriate, to provide input on safety and health to the Worker Occupational Safety and Health Committee, my supervisor and C-A management
- To take action when controls fail
- To contact supervision if unsure of how to perform the work or if the procedures are unclear or incorrect
- To ensure that my required training is current

5) What specific controls at C-AD can be implemented to reduce the potential for work related injury/illness?

- All Hazards
 - Work Planning
 - Pre-Job Safety Meetings
 - Safety Inspections / Safety Reviews / ALARA Reviews
 - Trained and Qualified Workers
 - Housekeeping
 - Area Posting With Appropriate Signs
 - Warning Tags and Lights
 - Work Permits
 - Proper Lighting in the Work Area
 - Compliance with OSHA Requirements
 - Communications
 - Procedures
 - Inspecting Personal Protective Equipment Before Use

- Effective Supervision at the Job Site
- Accurate Drawings
- Equipment Maintenance and Inspection
- Ionizing Radiation
 - Radiation Work Permits
 - Time, Distance and Shielding
 - Interlocks
 - Key Controls or Access Controls
 - Radiation Monitoring
 - Self-Reading Alarming Dosimeters
 - Fences and Enclosures
- Non-ionizing Radiation
 - Proper Eyewear for Lasers
 - Interlocks
 - rf monitoring
- Hazardous or Toxic Materials
 - Ventilation
 - Face Shields
 - Gloves
 - Safety Glasses
 - Leak Testing
 - Compliance with MSDS
 - HEPA Filters and Vacuums
 - Labeling
 - Secondary Containment
 - Spill Kits
 - Waste Controls
 - Use of Safe Substitutes
 - Use of Small Volumes
- Radioactive Materials
 - Radiation Work Permits
 - Contamination Controls
 - Waste Controls
- Electrical Energy
 - Working On or Near Energized Equipment Work Permits
 - Two-Man Rule Where Appropriate
 - Use of Shorting Bars for Electrical Safety
 - Maintaining Electrical Flash and Shock Boundaries
 - Lockout Tagout
 - Voltage Rated Gloves
 - Clothing to Protect Against Arc Flash Hazard
 - Use of Equipment that Meets UL or Equivalent Standards
 - GFCIs
 - Kirk Keys
 - Grounding
- Explosive Gases and Liquids

- Flammable Gas Monitors
 - Proper Containment and Piping
- Oxygen Deficiency
 - Oxygen Sensing Monitors
 - Self-Rescue Equipment
 - Confined Space Permit
- Kinetic Energy
 - Compliance with Traffic Rules and Traffic Control Signs
 - Frequent Work Breaks and Proper Posture to Prevent Repetitive Motion Injuries
 - Use of Dollies and Hand Trucks to Eliminate Manual Material Handling Tasks
 - Hard Hats
 - Safety Glasses
 - Safety Goggles
 - Hearing Protection
 - Gloves
 - Knee Pads
 - Elbow Pads
 - Ergonomic Reviews of Work Area
 - Steel-toed Shoes
 - Machine Guards
 - Barriers
 - Seat Belts
 - Noise Surveys
- Potential Energy
 - Fall Protection
 - Engineered Lifts
 - Inspecting Rigging Equipment Before Use
 - Knowing Proper Lifting Points on Load
 - Proper Scaffolding and Ladders
 - Wheel Locks
 - Magnetic Field Measurements
 - Railings
 - Smooth Non-Slippery Work Surfaces
 - Proper Lighting in Work Area
- Thermal Energy
 - Gloves
 - Fire Retardant Clothing
 - Fans
 - Water Breaks
 - Air Conditioning
 - Cutting and Welding Permit
- Cryogenic Temperatures
 - Gloves
- Protracted/Irregular Hours
 - Workers Not Expected to Work More Than 16 Hours Straight
 - Take Breaks Every Few Hours

- Allow at Least 8 Hours Between Work Periods
- Natural Hazards
 - Bug Spray
 - Housekeeping to Prevent Foraging by Animals and Insects
 - Awareness of the Possibility of Animals in Traffic Lanes
- Noise
 - Hearing Protection
 - Sound Barriers
 - Time Limits on Exposure
 - Medical Surveillance

6) What C-AD procedures or programs reduce the potential for work related injury/illness?

- [Authorization](#)
- [C-AD Building/Facility Information and Pictures](#)
- [Conduct of Operations](#)
- [Enhanced Work Permits](#)
- [Facility Specific Training](#)
- [Glove Selection for Chemicals at C-AD](#)
- [Hazard Screening Tool](#)
- [Housekeeping Policy](#)
- [How to Review an Accelerator for ESH](#)
- [Management Review](#)
- [Material Handling Requirements](#)
- [Permits for Working On or Near Energized Conductors](#)
- [Operations Procedure Manual](#)
- [OSH Management System](#)
- [Electrical Safety Implementation Plan](#)
- [Supplemental Electrical Safety Standard](#)
- [Tier 1 Schedule](#)
- [Work Controls for C-A Staff](#)
- [Work Permits](#)
- [WOSH Committee](#)

7) How would you respond in an emergency to reduce the potential for injury/illness and what actions could be taken to mitigate the event?

- See [C-A OPM 3.0](#), Local Emergency Plan for the C-A Department
- See [C-A OPM Chapter 10](#), Occurrence Reporting
- Dial 2222 or 911 (if calling from a cell phone, dial (631) 344-2222)
- Assemble at [Emergency Assembly Points](#)

8) What occupational safety and health techniques have been or could be considered to reduce or eliminate the potential risks associated with working in the accelerators?

The following preventive and protective measures in the following order of priority:

- Eliminate the hazard/risk (e.g., do not use a broken ladder or do not use tools with frayed power cords)
- Control the hazard/risk at source, through the use of engineering controls (e.g., use interlocks) or administrative measures (e.g., use LOTO)
- Minimize the hazard/risk through the use of safe work systems, which include administrative control measures such as check-off lists and work permits
- If residual hazards/risks cannot be controlled by the above measures, then use appropriate personal protective equipment, including clothing

9) Are there any key OSH-specific competency requirements for my position?

A job training assessment (JTA) is performed for every job category. Specific OSH training is listed in your [training record](#). Specific OSH courses available to address hazards in accelerators are listed in Section 4 of [Workplace Hazard and Risk Assessment for Accelerators](#).

10) What is the function of the C-AD Worker Occupational Safety and Health (WOSH) Committee?

The WOSH Committee was formed to ensure full worker participation in work-related OSH issues. This Committee meets at least once per quarter and consists of worker representatives from all of the C-AD Sections and Groups. Each meeting reviews the latest injury data, performance indicators, critiques and occurrences, and worker feedback. The Committee also assists in the review of programs, work practices, hazard identification, risk assessments and procedures as requested by the Associate Chair for ESHQ. The WOSH Committee procedure, [C-A-OPM 9.8.1](#), describes the WOSH Committee policy and requirements in detail.



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Building 911A
P.O. Box 5000
Upton, NY 11973-5000
Phone 631-344-7343
Fax 631-344-5676
maraviglia@bnl.gov

date: May 31, 2006
to: Course Participant
from: J. Maraviglia
subject: OSH Training for C-AD Accelerator Workers, Read & Acknowledgement

reference: Procedure: C-AD OPM 14.31.2

Please complete the information below indicating that you have read the reference document. Please return this completed form to ESH&Q Division, Ann Marie Luhrs, Bldg. 911A.

Thank you,
John Maraviglia

Name: _____ Life #: _____
Print

Name: _____ Date: _____
Signature

Please return this completed form to ESH&Q Division, Ann Marie Luhrs, Bldg. 911A.